

## PART A : PHYSICS

1. In the formula  $X = 3YZ^2$ ,  $X$  and  $Z$  have the dimensions of capacitance and magnetic induction, respectively. The dimensions of  $Y$  in M.K.S system are  
 (a)  $M^{-3}L^{-2}T^{-2}A^{-4}$  (b)  $M L^{-2} \dot{A}$   
 (c)  $M^{-3}L^{-2}T^8A^4$  (d)  $M^{-3}L^{-2}T^4A^4$
2. The number of significant figures in  $5.69 \times 10^{15}$  kg is  
 (a) 1 (b) 2  
 (c) 3 (d) 18
3. A student performs an experiment to determine the Young's modulus of a wire, exactly 2 m long, by Searle's method. In a particular reading, the student measures the extension in the length of the wire to be 0.8 mm with an uncertainty of  $\pm 0.05$  mm at a load of exactly 1.0 kg. The student also measures the diameter of the wire to be 0.4 mm with a uncertainty of  $\pm 0.01$  mm. Take  $g = 9.8 \text{ m/s}^2$  (exact). The Young's modulus obtained from the reading is (given  $Y = \frac{FL}{Al}$ )  
 (a)  $(2.0 \pm 0.3) \times 10^{11} \text{ N/m}^2$   
 (b)  $(2.0 \pm 0.2) \times 10^{11} \text{ N/m}^2$   
 (c)  $(2.0 \pm 0.1) \times 10^{11} \text{ N/m}^2$   
 (d)  $(2.0 \pm 0.05) \times 10^{11} \text{ N/m}^2$
4. The coefficient of viscosity ( $\eta$ ) of a liquid by the method of flow through a capillary tube is given by the formula  

$$\eta = \frac{\pi R^4 P}{8 l Q}$$
 where  $R$  = radius of the capillary tube,  
 $l$  = length of the tube,  
 $P$  = Pressure difference between its ends, and  
 $Q$  = Volume of liquid flowing per second  
 Which quantity must be measured most accurately?  
 (a)  $R$  (b)  $l$
- (c)  $P$  (d)  $Q$
5. The volume  $V$  of water passing any point of a uniform tube during  $t$  seconds is related to the cross-sectional area  $A$  of the tube and velocity  $u$  of water by the relation  

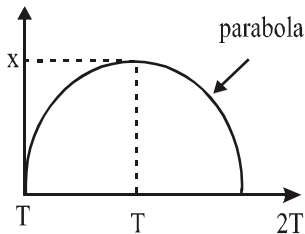
$$V \propto A^\alpha u^\beta t^\gamma$$
 which one of the following will be true?  
 (a)  $\alpha = \beta = \gamma$  (b)  $\alpha \neq \beta = \gamma$   
 (c)  $\alpha = \beta \neq \gamma$  (d)  $\alpha \neq \beta \neq \gamma$
6. Frequency ( $n$ ) of a tuning fork depends upon length ( $l$ ) of its prongs, density ( $\rho$ ) and Young's modulus ( $Y$ ) of its material. Then frequency and Young's modulus will be related as  
 (a)  $n \propto \sqrt{Y}$  (b)  $n \propto Y$   
 (c)  $n \propto \frac{1}{\sqrt{Y}}$  (d)  $n \propto \frac{1}{Y}$
7. A gas bubble from an explosion under water oscillates with a period proportional to  $P^a d^b E^c$  where  $P$  is the static pressure,  $d$  is the density of water and  $E$  is the energy of explosion. Then  $a$ ,  $b$ , and  $c$  respectively are  
 (a)  $\frac{-5}{6}, \frac{1}{2}, \frac{1}{3}$  (b)  $\frac{1}{2}, \frac{-5}{6}, \frac{1}{3}$   
 (c)  $\frac{1}{3}, \frac{1}{2}, \frac{-5}{6}$  (d) 1, 1, 1
8. Of the following quantities which one has the dimensions different from the remaining three?  
 (1) Energy density  
 (2) Force per unit area  
 (3) Product of charge per unit volume and voltage  
 (4) Angular momentum per unit mass  
 (a) 1 (b) 2  
 (c) 3 (d) 4
9. Volume of liquid flowing per second through a capillary tube  $V$  is given by  

$$V = \frac{K(x_2 - x_1)^4}{(y_2 - y_1)}$$
 where  $x_1$  and  $x_2$  are inner and outer radii and  $y_2$  and  $y_1$  are the

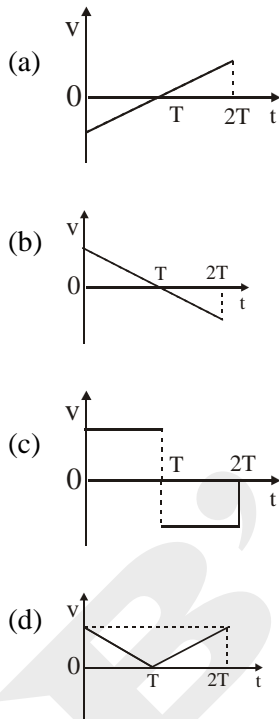
- positions crossed by the liquid. The dimensional formula for  $K$  is
- (a)  $M^0L^0T^0$  (b)  $MLT^2$   
 (c)  $ML^{-1}T^{-1}$  (d)  $M^0L^0T^{-1}$
10. The number of particles crossing a unit area perpendicular to the  $X$ -axis in a unit time is given by  $n = -D \left( \frac{n_2 - n_1}{x_2 - x_1} \right)$ , where  $n_1$  and  $n_2$  are the number of particles per unit volume at  $x = x_1$  and  $x = x_2$ , respectively, and  $D$  is the diffusion constant. The dimensions of  $D$  are
- (a)  $[M^0L^2T^{-2}]$  (b)  $[M^0L^2T^{-4}]$   
 (c)  $[M^0L^2T^{-2}]$  (d)  $[M^0L^2T^{-1}]$
11. Find out the torque of a force  $F = (2\hat{i} + \hat{j} - \hat{k})$  about origin; when position vector of point of application of force is  $r = (2\hat{i} + \hat{j} + 3\hat{k})$
- (a)  $6\hat{i} - 8\hat{j} + 2\hat{k}$  (b)  $4\hat{i} + 8\hat{j}$   
 (c)  $-4\hat{i} + 8\hat{j}$  (d)  $6\hat{i} + 8\hat{j} + \hat{k}$
12. A particle is moving in a plane with velocity given by  $\vec{v} = v_0\hat{i} + a\omega \cos \omega t \hat{j}$ . If the particle is at origin at  $t = 0$ , distance from origin at time  $\frac{2\pi}{2\omega}$  is
- (a)  $\sqrt{a^2 + \left(\frac{3\pi v_0}{2\omega}\right)^2}$  (b)  $\sqrt{a^2 + \left(\frac{2\pi v_0}{2\omega}\right)^2}$   
 (c)  $\left(\frac{\pi v_0}{\omega}\right)^2 + a^2$  (d)  $\sqrt{a^2 + \left(\frac{2\pi v_0}{3\omega}\right)^2}$
13. The magnitude of the resultant of  $(A + B)$  and  $(A - B)$  is
- (a)  $2A$  (b)  $2B$   
 (c)  $\sqrt{A^2 + B^2}$  (d)  $\sqrt{A^2 - B^2}$
14. Vector  $\vec{A}$  is 2 cm long and is  $60^\circ$  above the  $x$ -axis in the first quadrant. Vector  $\vec{B}$  is 2 cm long and is  $60^\circ$  below the  $x$ -axis in the fourth quadrant. The sum  $\vec{A} + \vec{B}$  is a vector of magnitude
- (a) 2 along +  $y$ -axis  
 (b) 2 along +  $x$ -axis  
 (c) 1 along -  $x$ -axis  
 (d) 2 along -  $x$ -axis
15. The coordinates of a particle moving in a plane are given by  $x = 4 \cos 10t$ , and  $y = 3 \sin 10t$ .
- (a) the equation of the path of the particle is ellipse  
 (b) the angle between position vector and velocity is  $\pi/2$  at time  $t = \pi/20$   
 (c) acceleration is directed toward origin  
 (d) all of these
16. Two balls of different masses  $m_a$  and  $m_b$  are dropped from two different heights  $a$  and  $b$ . The ratio of the time taken by the two to drop through these distances are
- (a)  $a : b$  (b)  $b : a$   
 (c)  $\sqrt{a} : \sqrt{b}$  (d)  $a^2 : b^2$
17. A body dropped from the top of the tower covers a distance  $7x$  in the last second of its journey, where  $x$  is the distance covered in first second. How much time does it take to reach the ground?
- (a) 3s (b) 4s  
 (c) 5s (d) 6s
18. Velocity of a particle moving in a straight line varies with displacement as  $V = (\sqrt{4 + 4S})$  m/s. Displacement of particle at time  $t = 0$  is  $s = 0$ . The displacement of particle at time  $t = 2$  sec is
- (a) 2m (b) 4m  
 (c) 6m (d) 8m
19. A ball is released from the top of a tower of height  $h$  meters. It takes  $T$  seconds to reach the ground. What is the position of the ball at  $\frac{T}{3}$  second?
- (a)  $\frac{8h}{9}$  meters from the ground  
 (b)  $\frac{7h}{9}$  meters from the ground

- (c)  $\frac{h}{9}$  meters from the ground
- (d)  $\frac{17h}{18}$  meters from the ground

20. The x-t graph of a particle moving along a straight line is shown in figure



The v-t graph of a particle is correctly shown by

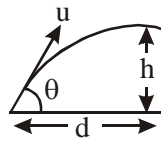


21. If the volume of a spherical balloon is increasing at the rate of  $900 \text{ cm}^3$  per sec, then the rate of change of radius of balloon at instant when radius is  $15 \text{ cm}$  [in  $\text{cm}/\text{sec}$ ]
- (a)  $\frac{22}{7}$  (b) 22
  - (c)  $\frac{7}{22}$  (d) None of these
22. A body falling freely from a given height  $H$  hits an inclined plane in its path at a height

'h'. As a result of this impact the direction of the velocity of the body becomes horizontal. Find the total time the body will take to reach the ground.

- (a)  $\sqrt{\frac{2}{g}}(\sqrt{h} + \sqrt{H-h})$
- (b)  $\sqrt{2gh}$
- (c)  $\sqrt{\frac{2}{g}}(\sqrt{H-h})$
- (d) none of the above

23. An air craft executes a horizontal loop of radius  $1 \text{ km}$  with a steady speed of  $900 \text{ kmh}^{-1}$ . Find its centripetal acceleration.
- (a)  $62.5 \text{ m/s}^2$  (b)  $30 \text{ m/s}^2$
  - (c)  $32.5 \text{ m/s}^2$  (d)  $72.5 \text{ m/s}^2$
24. The resultant of velocity of two cars moving with equal speeds and the ratio of magnitude is  $\frac{R_2}{R_1} = \sqrt{3}$ , when the direction of either car is reversed. The angle between the direction of cars is
- (a)  $30^\circ$  (b)  $60^\circ$
  - (c)  $120^\circ$  (d) None of these
25. A body is moving in a circle at a uniform speed  $v$ . What is the magnitude of the change in velocity when the radius vector describes an angle  $\theta$
- (a)  $v_0 \cos \theta$  (b)  $2v_0 \cos\left(\frac{\theta}{2}\right)$
  - (c)  $v_0 \sin \theta$  (d)  $2v_0 \sin\left(\frac{\theta}{2}\right)$
26. If a particle takes  $t$  second less and acquires a velocity of  $v \text{ ms}^{-2}$  more in falling through the same distance on two planets where the accelerations due to gravity are  $2g$  and  $8g$  respectively then
- (a)  $v = 4gt$  (b)  $v = 5gt$
  - (c)  $v = 2gt$  (d)  $v = 16gt$
27. If a stone is hit at a point which is at a distance  $d$  away and at a height  $h$  (see figure) above the point from where the stone starts, then what is the value of initial speed  $u$  if the stone is launched at an angle  $\theta$ ?



- (a)  $\frac{g}{\cos \theta} \sqrt{\frac{d}{2(d \tan \theta - h)}}$   
 (b)  $\frac{d}{\cos \theta} \sqrt{\frac{g}{2(d \tan \theta - h)}}$   
 (c)  $\sqrt{\frac{gd^2}{h \cos^2 \theta}}$   
 (d)  $\sqrt{\frac{gd^2}{(d - h)}}$
28. An aeroplane is flying horizontally with a velocity of 600 km/hr and at a height of 2000 m. When it is vertically above a point A on the ground, a bomb is released from it. The bomb strikes the ground at point B. The distance AB is (neglecting air resistance)
- (a) 1,200 m                      (b) 0.33 km  
 (c) 3.33 km                      (d) 33 km

29. The rate of change of  $\sqrt{(x^2 + 16)}$  with respect to  $\frac{x}{x-1}$  at  $x = 3$  is
- (a) 2                                      (b)  $\frac{11}{5}$   
 (c)  $-\frac{12}{5}$                                   (d) -3
30.  $\int (\sin^{-1} x + \cos^{-1} x) dx =$
- (a)  $\frac{1}{2} \pi x + c$   
 (b)  $x(\sin^{-1} x - \cos^{-1} x) + c$   
 (c)  $\frac{\pi}{2} + x + c$   
 (d) None of these

**PART B: MATHEMATICS**

31. Let  $A = [x : x \in R, |x| < 1]$ ;  
 $B = [x : x \in R, |x - 1| \geq 1]$  and  
 $A \cup B = R - D$ , then the set D is
- (a)  $[x : 1 < x \leq 2]$                       (b)  $[x : 1 \leq x < 2]$   
 (c)  $[x : 1 \leq x \leq 2]$                       (d) none of these
32. Which of the following is not the general solution of the equation  $2^{\cos 2x} + 1 = 3 \cdot 2^{-\sin^2 x}$
- (a)  $n\pi, n \in Z$   
 (b)  $\left(n + \frac{1}{2}\right)\pi, n \in Z$   
 (c)  $\left(n - \frac{1}{2}\right)\pi, n \in Z$   
 (d) None of these

33. The relative position of four ships A, B, C, D, in a sea area as follows: B is on line segment AC; B is north to D and D is just west to C,  $BD = 2$  km. If  $\angle BDA = 40^\circ$ ,  $\angle BCD = 25^\circ$ , then distance between A and D is : (here  $\sin 25^\circ = 0.423$ )
- (a) 3.28 km                                  (b) 3.46 km  
 (c) 4.28 km                                  (d) 4.83 km
34. R is a relation on N given by  $R = \{(x, y) : 4x + 3y = 20\}$ . Which of the following belongs to R ?
- (a) (2, 4)                                      (b) (3, 4)  
 (c) (5, 0)                                      (d) (-4, 12)
35. The domain the function  $f(x) = x^{\frac{1}{\log x}}$  is
- (a)  $(0, \infty) - \{1\}$                               (b)  $(0, \infty)$

- (c)  $[0, \infty)$  (d)  $[0, \infty) - \{1\}$
36. If  $\sin \theta = \frac{1}{2}$  and  $\cos \theta = -\frac{\sqrt{3}}{2}$ , then the general value of  $\theta$  is ( $n \in \mathbb{Z}$ )
- (a)  $2n\pi + \frac{5\pi}{6}$  (b)  $2n\pi + \frac{\pi}{6}$   
 (c)  $2n\pi + \frac{7\pi}{6}$  (d)  $2n\pi + \frac{\pi}{4}$
37. If  $y = (1 + \tan A)(1 - \tan B)$  where  $A - B = \frac{\pi}{4}$ , then  $(y + 1)^{y+1}$  is equal to
- (a) 9 (b) 4  
 (c) 27 (d) 81
38. If A, B, C, D are the smallest positive angles in ascending order of magnitude which have their sines equal to the positive quantity  $k$ , then the value of  $4\sin \frac{A}{2} + 3\sin \frac{B}{2} + 2\sin \frac{C}{2} + \sin \frac{D}{2}$  is equal to
- (a)  $2\sqrt{1-k}$  (b)  $2\sqrt{1+k}$   
 (c)  $2\sqrt{k}$  (d) None of these
39. If  $A = \{1, 2, 3, 4, 5\}$  and  $B = \{2, 3, 6, 7\}$ , then the number of elements in the set  $(A \times B) \cap (B \times A)$  is equal to
- (a) 4 (b) 5  
 (c) 10 (d) 20
40. The relation R on the set  $A = \{x / |x| < 3, n \in \mathbb{Z}\}$  is defined by  $R = \{(x, y) : y = |x|, x \neq -1\}$ . Then the number of elements in the power set of R is
- (a) 32 (b) 16  
 (c) 8 (d) 64
41. The sum of all the solutions of the equation  $\cos \theta \cos \left(\frac{\pi}{3} + \theta\right) \cos \left(\frac{\pi}{3} - \theta\right) = \frac{1}{4}, \theta \in [0, 6\pi]$
- (a)  $15\pi$  (b)  $30\pi$   
 (c)  $\frac{100\pi}{3}$  (d) None of these
42. If  $\sin \alpha + \sin \beta = a$  and  $\cos \alpha + \cos \beta = b$ , then  $\tan \frac{\alpha - \beta}{2}$  is equal to
- (a)  $\pm \sqrt{\frac{4 - a^2 + b^2}{a^2 + b^2}}$  (b)  $\pm \sqrt{\frac{4 - a^2 - b^2}{a^2 + b^2}}$   
 (c)  $\pm \sqrt{\frac{4 + a^2 - b^2}{a^2 + b^2}}$  (d)  $\pm \sqrt{\frac{4 + a^2 - b^2}{a^2 b^2}}$
43. In a class of 55 students, the number of students studying different subjects are 23 in mathematics, 24 in physics, 19 in chemistry, 12 in mathematics and physics, 9 in mathematics and chemistry, 7 in physics and chemistry and 4 in all the three subjects. The number of students who have taken exactly one subject is
- (a) 6 (b) 9  
 (c) 7 (d) all of these
44. If two sets A and B are having 99 elements in common, then the number of elements common to each of the sets  $A \times B$  and  $B \times A$  are
- (a)  $2^{99}$  (b)  $99^2$  (c) 100 (d) 18
45. The interval of values of  $\alpha$  for which the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = \frac{\alpha x^2 + 6x - 8}{\alpha + 6x - 8x^2}$  is onto, is
- (a)  $[2, 14]$  (b)  $(2, 14)$   
 (c)  $[2, 14)$  (d) none of these
46. A lamp post standing at a point A on a circular path of radius  $r$  subtends an angle  $\alpha$  at some point B on the path, and AB subtends an angle of  $45^\circ$  at any other point on the path, then height of the lamp post is
- (a)  $\sqrt{2} r \cot \alpha$  (b)  $(r/\sqrt{2}) \tan \alpha$   
 (c)  $\sqrt{2} r \tan \alpha$  (d)  $(r/\sqrt{2}) \cot \alpha$
47. If  $\tan \alpha = \frac{1}{7}, \sin \beta = \frac{1}{\sqrt{10}}$ , then the value of  $\alpha + 2\beta$  is where  $0 < \alpha < \frac{\pi}{2}$  and  $0 < \beta < \frac{\pi}{2}$
- (a)  $\frac{\pi}{2}$  (b)  $\frac{\pi}{3}$  (c)  $\pi$  (d)  $\frac{\pi}{4}$
48. The period of the function  $f(x) = x - [x]$ , where  $[x]$  denotes the greatest integer less than or equal to  $x$ , is

- (a) 2 (b) 1  
(c) 4 (d) none of these
49. If  
 $A = \{x : x^2 - 5x + 6 = 0\}, B = \{2, 4\}, C = \{4, 5\}$ ,  
 then  $A \times (B \cap C)$  is  
 (a)  $\{(2, 4), (3, 4)\}$   
 (b)  $\{(4, 2), (4, 3)\}$   
 (c)  $\{(2, 4), (3, 4), (4, 4)\}$   
 (d)  $\{(2, 2), (3, 3), (4, 4), (5, 5)\}$
50. A tower subtends an angle  $\alpha$  at a point on the same level as the foot of the tower and the second point  $h$  metres above the first point the depression of the foot of tower is  $\beta$ . Then the height of the tower is  
 (a)  $h \sin \alpha \cdot \cos \beta$  (b)  $h \tan \alpha \cdot \cot \beta$   
 (c)  $h \sin \beta \cdot \tan \alpha$  (d)  $h \cot \alpha \cdot \tan \beta$
51. Given  
 $n(U) = 20, n(A) = 12, n(B) = 9, n(A \cap B) = 4$   
 where  $U$  is the universal set,  $A$  and  $B$  are subsets of  $U$ , then  $n((A \cup B)^c) =$   
 (a) 17 (b) 9 (c) 11 (d) 3
52. The angle of elevation of a cloud from a point  $h$  metre above is  $\theta^\circ$  and the angle of depression of its reflection in the lake is  $\phi$ , then the height is  
 (a)  $\frac{h \sin(\phi - \theta)}{\sin(\phi + \theta)}$  (b)  $\frac{h \sin(\phi + \theta)}{\sin(\phi - \theta)}$   
 (c)  $\frac{h \sin(\theta + \phi)}{\sin(\theta - \phi)}$  (d) None of these
53. The domain of definition of the function  
 $f(x) = \frac{\log(2x-3)}{\sqrt{x-1}} + \sqrt{5-2x}$  is  
 (a)  $\left(1, \frac{5}{2}\right)$  (b)  $\left[\frac{3}{2}, \frac{5}{2}\right)$   
 (c)  $\left[1, \frac{5}{2}\right]$  (d)  $\left(\frac{3}{2}, \frac{5}{2}\right]$
54. If  $\alpha$  and  $\beta$  are distinct roots of  $a \cos \theta + b \sin \theta = c$ , then the value of  $\sin(\alpha + \beta)$  is  
 (a)  $\frac{2b}{a^2 + b^2}$  (b)  $\frac{2ab}{a^2 + b^2}$   
 (c)  $\frac{2ab}{a^2 - b^2}$  (d)  $\frac{ab}{a^2 - b^2}$
55. Two finite sets have  $m$  and  $n$  elements. The total number of subsets of the first set is 48 more than the total number of subsets of the second set. The values of  $m$  and  $n$  are  
 (a) 7, 6 (b) 6, 3  
 (c) 6, 4 (d) 7, 4
56. A relation  $R$  from  $C$  to  $R$  is defined by  $xRy$  iff  $|x| = y$ .  
 Which of the following is correct ?  
 (a)  $(2 + 3i)R13$  (b)  $3R(-3)$   
 (c)  $(1 + i)R2$  (d)  $iR1$
57. If  $\tan(x + 100^\circ) = \tan(x + 50^\circ) \tan x \tan(x - 50^\circ)$ , then the smallest positive value of  $x$  (in degrees) is  
 (a)  $x = 30^\circ$  (b)  $x = 25^\circ$   
 (c)  $x = 18^\circ$  (d)  $x = 20^\circ$
58. The equation  $\sin^6 x + \cos^6 x = a^2$  has a real solution if  
 (a)  $a \in (-1, 1)$  (b)  $a \in (-1, -1/2)$   
 (c)  $a \in (-1/2, 1/2)$  (d)  $a \in (1/2, 1)$
59. If  $\tan \alpha = \frac{p}{q}$ , where  $\alpha = 6\beta$ ,  $\alpha$  being an acute angle, then  $\frac{1}{2}\{p \operatorname{cosec} 2\beta - q \sec 2\beta\}$  is  
 (a)  $\sqrt{p^2 - q^2}$  (b)  $\sqrt{p^3 - q^3}$   
 (c)  $\sqrt{p^2 + q^2}$  (d) None of these
60. The range of the function  
 $y = f(x) = \sin[x], -\frac{\pi}{4} < x < \frac{\pi}{4}$ , where  $[x]$  denotes the greatest integer  $\leq x$  is  
 (a)  $\{0\}$  (b)  $\{0, -1\}$   
 (c)  $\{0, \pm \sin 1\}$  (d)  $\{0, -\sin 1\}$

## PART C: CHEMISTRY

61. A gaseous mixture contains oxygen and nitrogen in the ratio of 1 : 4 by weight. Therefore, the ratio of their number of molecules is  
 (a) 1 : 4 (b) 1 : 8  
 (c) 7 : 32 (d) 3 : 16
62. The largest number of molecules is in  
 (a) 36 g of water  
 (b) 28 g of carbon monoxide  
 (c) 46 g of ethyl alcohol  
 (d) 54 g of nitrogen pentoxide
63. 2.76 g of silver carbonate on being strongly heated yields a residue weighing  
 (a) 2.16 g (b) 2.48 g  
 (c) 2.32 g (d) 2.64 g
64. What is the stoichiometric coefficient of  $Ca$  in the reaction ?  $Ca + Al^{3+} \rightarrow Ca^{2+} + Al$   
 (a) 2 (b) 1  
 (c) 3 (d) 4
65. The equivalent weight of  $MnSO_4$  is half its molecular weight when it is converted to  
 (a)  $Mn_2O_3$  (b)  $MnO_2$   
 (c)  $MnO_4^-$  (d)  $MnO_4^{2-}$
66. The percentage of  $P_2O_5$  in diammonium hydrogen phosphate  $(NH_4)_2HPO_4$  is  
 (a) 23.48 (b) 46.96  
 (c) 53.78 (d) 71.00
67. The number of moles of  $KI$  required to produce 0.4 moles of  $K_2HgI_4$  by reaction with  $HgCl_2$  is  
 (a) 0.4 (b) 0.8  
 (c) 3.2 (d) 1.6
68. In the standardization of  $Na_2S_2O_3$  using  $K_2Cr_2O_7$  by iodometry, the equivalent weight of  $K_2Cr_2O_7$  is  
 (a) molecular weight / 2  
 (b) molecular weight / 6  
 (c) molecular weight / 3  
 (d) same as molecular weight
69. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 N  $NaOH$  required to completely neutralize 10 mL of this solution is  
 (a) 40 mL (b) 20 mL  
 (c) 10 mL (d) 4 mL
70. Mixture X = 0.02 mole of  $[Co(NH_3)_5SO_4] Br$  and 0.02 mole of  $[Co(NH_3)_5Br]SO_4$  was prepared in 2 L of solution.  
 1 L of mixture X + excess  $AgNO_3 \rightarrow Y$   
 1 L of mixture X + excess  $BaCl_2 \rightarrow Z$   
 Number of moles of Y and Z are  
 (a) 0.01, 0.01 (b) 0.02, 0.01  
 (c) 0.01, 0.02 (d) 0.02, 0.02
71. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is  
 (a) 3 (b) 4  
 (c) 5 (d) 6
72. Which of the following contains largest number of atoms ?  
 (a) 1 g of  $C_2H_4$  (b) 1 g of ozone  
 (c) 1 g of oxygen (d) 1 g of helium
73. 300 ml of 3.0 M  $NaCl$  is added to 200 ml of 4.0 M  $BaCl_2$  solution. The concentration of  $Cl^-$  ions in the resulting solution is  
 (a) 7 M (b) 1.6 M  
 (c) 1.8 M (d) 5 M
74. A solution containing 0.1 mol of a metal chloride  $MCl_x$  requires 500 ml of 0.8 M  $AgNO_3$  solution for complete precipitation. The value of  $x$  is  
 (a) 1 (b) 2  
 (c) 4 (d) 3
75. When 4.0 g of iron is burnt at high temperature to ferric oxide at constant pressure 29.28 kJ of heat is evolved. The amount of heat evolved for producing one mole of ferric oxide is  
 (a) 819.84 kJ (b) 40.99 kJ  
 (c) 81.98 kJ (d) 409.9 kJ
76. A sample of gas occupies 100 litres at 1 atm pressure and at  $0^\circ C$ . If the volume of the gas is to be reduced to 5 litres at the same temperature, what additional pressure must be applied ?

- (a) 18 atm (b) 19 atm  
(c) 21 atm (d) 10 atm
77. At which of the four conditions, the density of nitrogen will be the largest ?  
(a) STP (b) 273 K and 2 atm  
(c) 546 K and 1 atm (d) 546 K and 2 atm
78. A balloon of diameter 20 m weights 100 kg. What is its pay – load, if it is filled with He at 1 atm and 27°C. Density of air is  $1.2 \text{ kg m}^{-3}$   
(a)  $424.67 \times 10^4 \text{ g}$  (b)  $424.67 \times 10^2 \text{ g}$   
(c)  $424.67 \times 10^5 \text{ g}$  (d) None of these
79. At an underwater depth of 250 ft; the pressure is 8.38 atm. What should be the mole percent of oxygen in the diving gas for the partial pressure of oxygen in the mixture to be 0.21 atm, the same as it is in air at 1 atm ?  
(a) 2.5% (b) 3.4% (c) .025% (d) .034%
80. A certain gas diffuses from two different vessels A and B. The vessel A has a circular orifice while vessel B has a square orifice of length equal to the radius of the orifice of vessel A. The ratio of the rates of diffusion of the gas from vessel A to vessel B, assuming same temperature and pressure is;  
(a)  $\pi$  (b)  $1/\pi$  (c) 1:1 (d) 2:1
81. At what temperature will the r.m.s. velocity of oxygen be one and half times of its value at N.T.P. ?  
(a) 614.25 K (b) 525 K  
(c) 519.25 K (d) 114.25 K
82. 1 mole of  $\text{SO}_2$  occupies a volume of 350 ml at 300K and 50 atm pressure. What is the compressibility factor of the gas.  
(a) 1.0 (b) 0.09 (c) 2.12 (d) 0.71
83. The behaviour of a real gas is usually depicted by plotting compressibility factor Z versus P at a constant temperature. At high temperature and high pressure, Z is usually more than one. This fact can be explained by van der Waal's equation when  
(a) the constant 'a' is negligible and not 'b'  
(b) the constant 'b' is negligible and not 'a'  
(c) both constants 'a' and 'b' are negligible  
(d) both the constants 'a' and 'b' are not negligible.
84. In Victor Meyer's experiment, 0.23g of a volatile solute displaced air which measures 112 ml at NTP. The vapour density and molecular weight of the substance is.  
(a) 23.01 and 11.05 (b) 46.02 and 23.01  
(c) 23.01 and 43.01 (d) 43.01 and 21.50
- 85.. A cylindrical balloon of 21 cm diameter is to be filled up with  $\text{H}_2$  at NTP from a cylinder containing the gas at 20 atm at 27°C. The cylinder can hold 2.82 litre of water at NTP. How many numbers of balloons can be filled up.  
(a) 40 (b) 20  
(c) 10 (d) 5
86. A 20g chunk of dry ice is placed in an empty 0.75 litre wire bottle tightly closed, what would be the final pressure in the bottle after all  $\text{CO}_2$  has been evaporated and temperature reaches to 25°C ?  
(a) 15.83 atm (b) 14.82 atm  
(c) 1.58 atm (d) None
87. 50 litre of dry  $\text{N}_2$  is passed through 36g of  $\text{H}_2\text{O}$  at 27°C. After passage of gas, there is a loss of 1.20g in water. Calculate vapour pressure of water.  
(a) 32.48 mm (b) 24.95 mm  
(c) 30.56 mm (d) None of these
88. The average speed of an ideal gas molecule at 27°C is  $0.3 \text{ m sec}^{-1}$ . Calculate average speed at 927°C.  
(a)  $0.6 \text{ m sec}^{-1}$  (b)  $1.0 \text{ m sec}^{-1}$   
(c)  $1.4 \text{ m sec}^{-1}$  (d)  $2.8 \text{ m sec}^{-1}$
89. Pure  $\text{O}_2$  diffuses through an aperture in 224 seconds, whereas mixture of  $\text{O}_2$  and another gas containing 80%  $\text{O}_2$  diffuses from the same in 234 sec. What is the molecular weight of gas ?  
(a) 46.6 (b) 34.92  
(c) 48.6 (d) None
90. An LPG cylinder contains 15 kg of butane gas at 27°C and 10 atmospheric pressure. It was leaking and its pressure fell down to 8 atmospheric pressure after one day. The gas leaked is  
(a) 1 kg (b) 2 kg  
(c) 3 kg (d) 4 kg